Earth Observation Data Continuity and Dependencies in Australia's R&D Sector

ISPRS – ISRSE EO Forum

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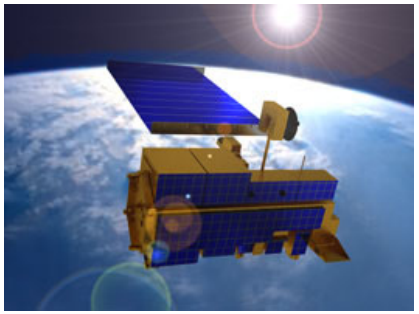
International Center for Remote Sensing of Environment

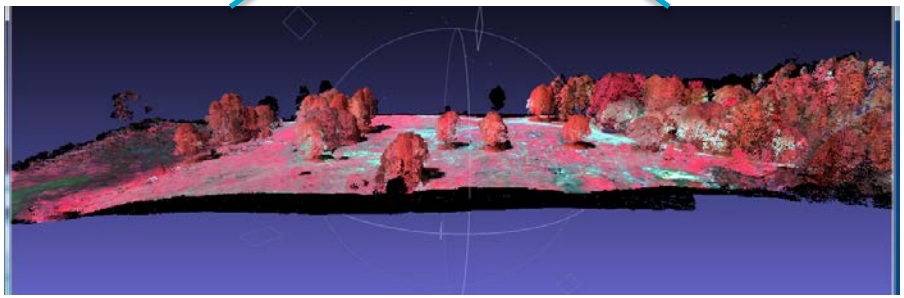
isprs information from imagery

CSIRO

Australia is one of largest users in the world of EO Data

Airborne Systems and new sensor Technologies; Hymap HSI build in Australia

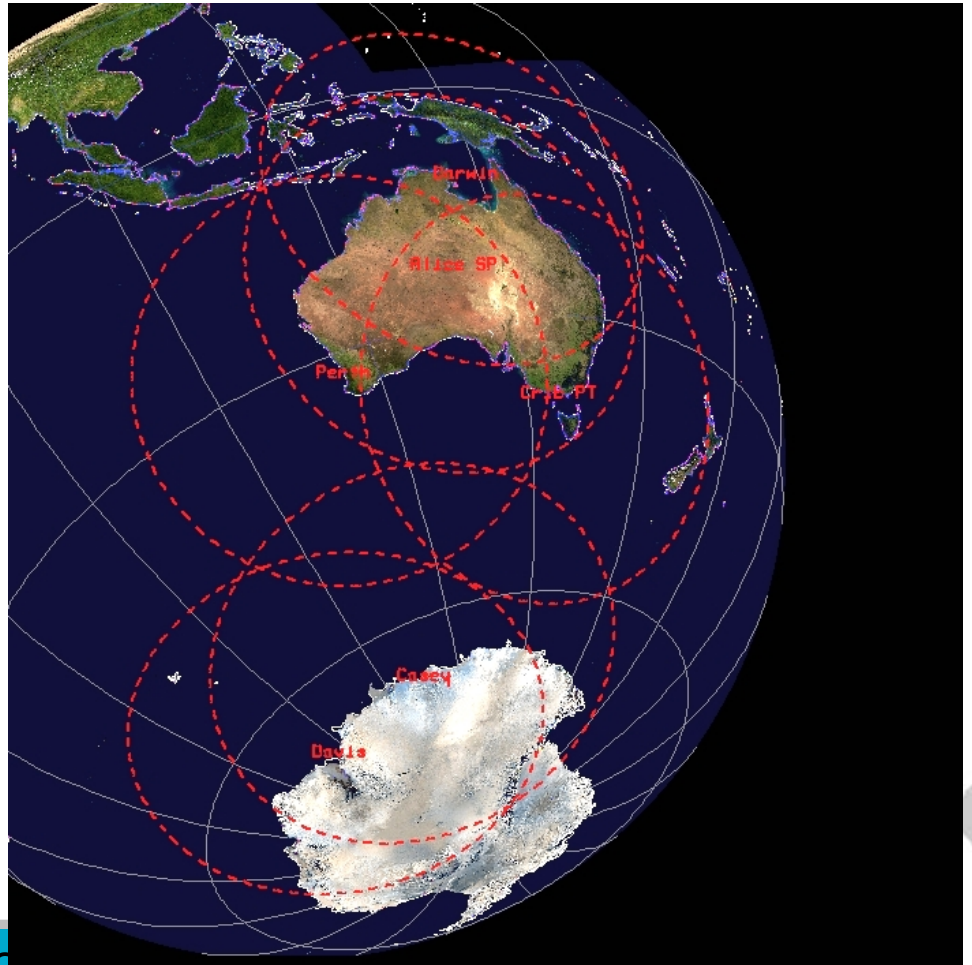




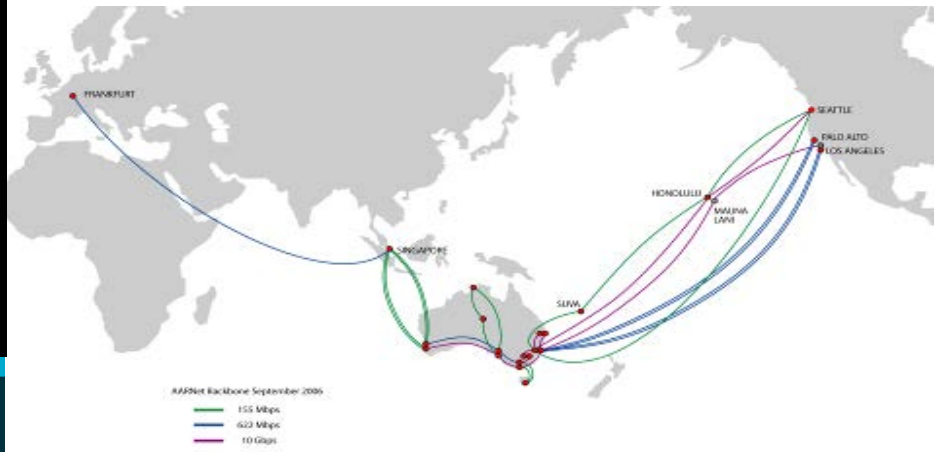
Low-spatial resolution, high temporal resolution Satellite Measurements

High-Resolution, Field-based Measurements

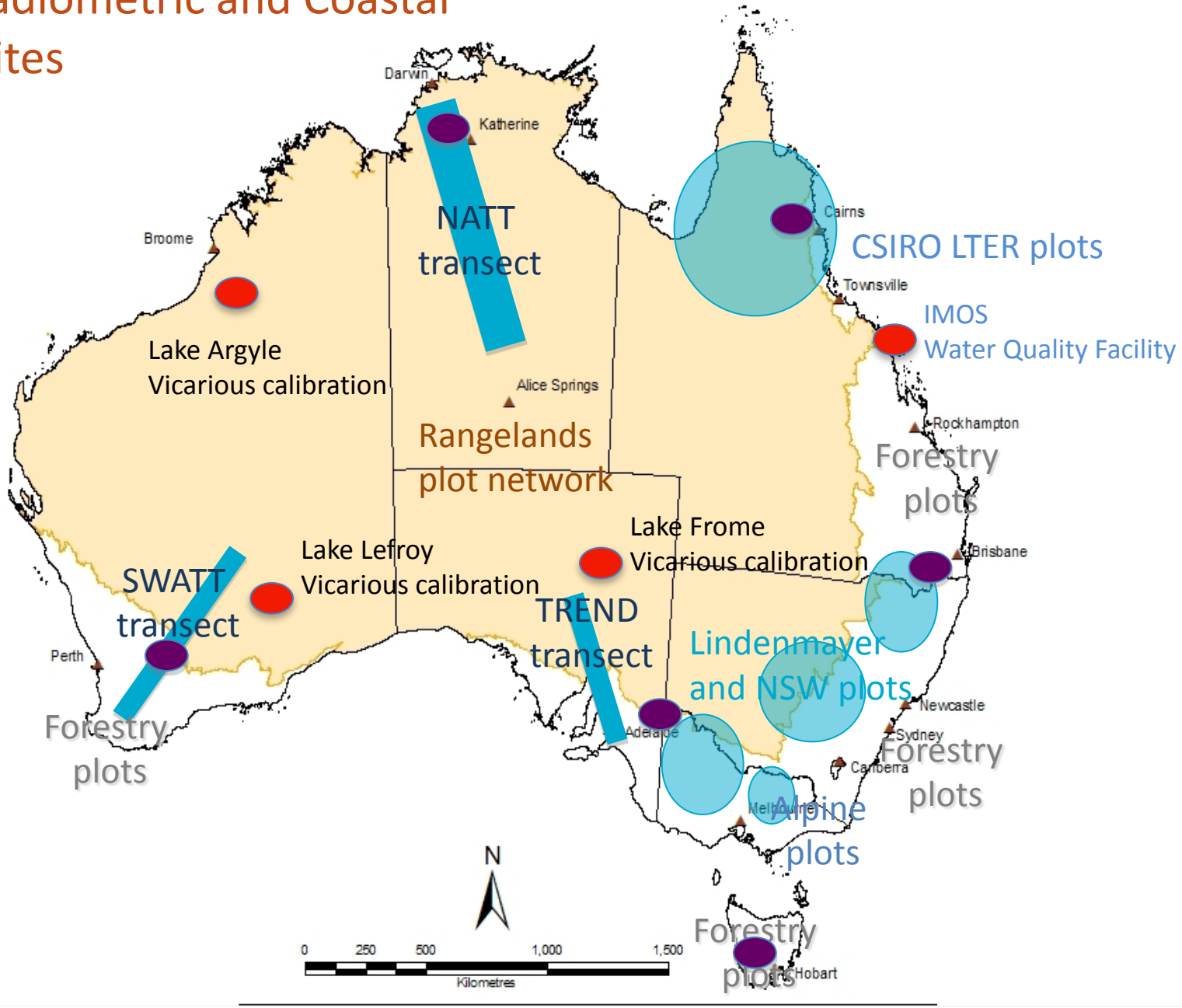
Current Satellite Reception Facilities & National Data Networks



- Facilities in Darwin with dual-pol X-band and future Ka-band downlink
- Science program on satellite – ground lidar communications
- Interconnected national broadband to international data centres
- Mass-data processing R&D



Several Radiometric and Coastal CAL/Val Sites

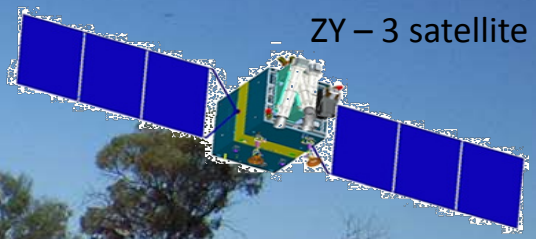


Organization development and utilization of space systems Foundation

HYPER project

MENU | Joint research

topographic mapping and environmental applications



ZY – 3 satellite

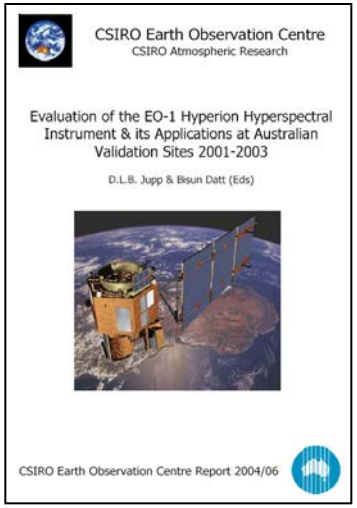
With German, Japanese and Chinese space agencies: influence in satellite design and the development of algorithms to guide the new suite of hyperspectral satellites. Better effectiveness for Australian crops, pastures and soils

Australia Collaborations/Partnerships

(e.g. U.S.A., Germany, Japan, Italy...)

What is Offered:

•Extensive experience in Applications Development, as demonstrated during NASA EO-1 Science Validation Team participation and other field campaigns, and ongoing use of Hyperion data.



•Radiometric calibration/validation laboratories and Field instrumentation: Part of federal research infrastructure programs (e.g. TERN, IMOS, tec.)

• A National Satellite Calibration Working Group, supported by DIISRTE SPU, CSIRO and Geoscience Australia

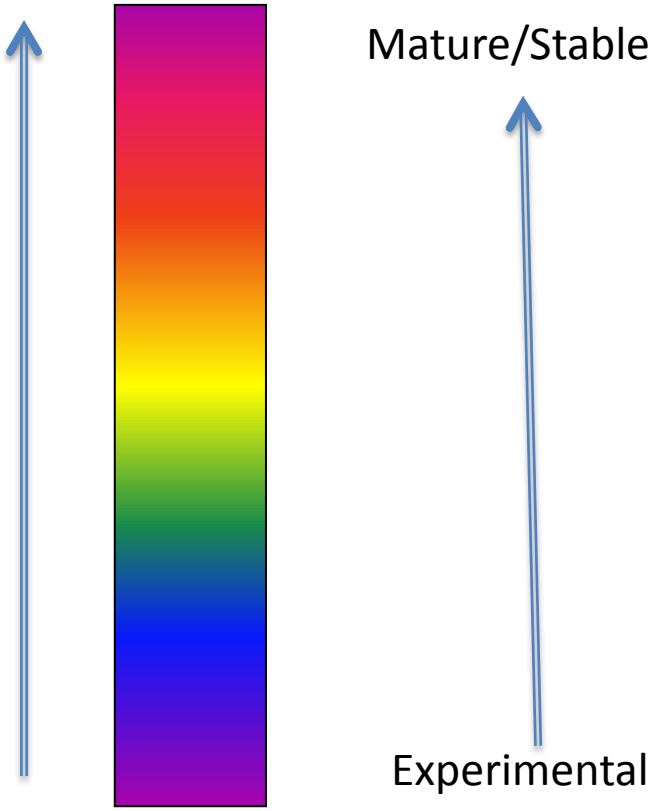
•Access to airborne data from Hymap, Spechim, and other imaging spectrometer data sensors

• Direct-readout capabilities, and processing via planned upgrades in dual-pol X-, Ka-band stations (Hobart & Darwin)

CSI

R&D and Applications Development across Spectrum of Remote Sensing Data Products

“Operational/Routine”

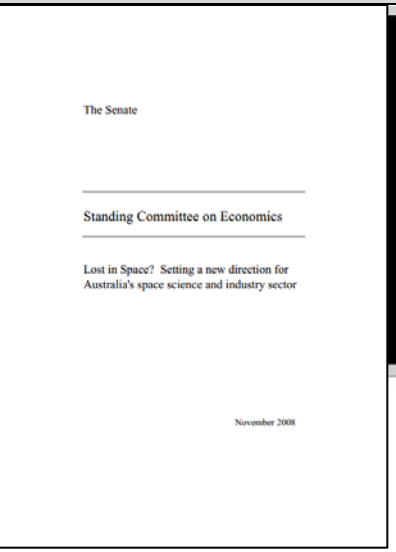


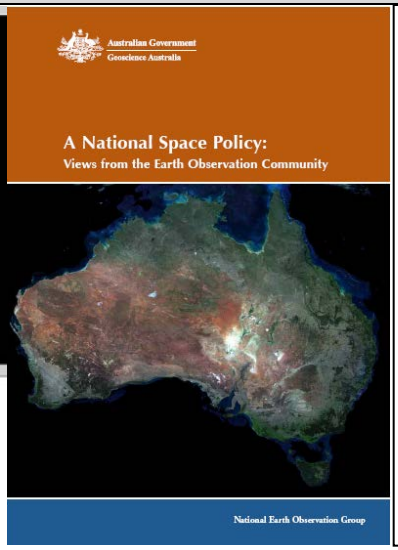
Research and Development

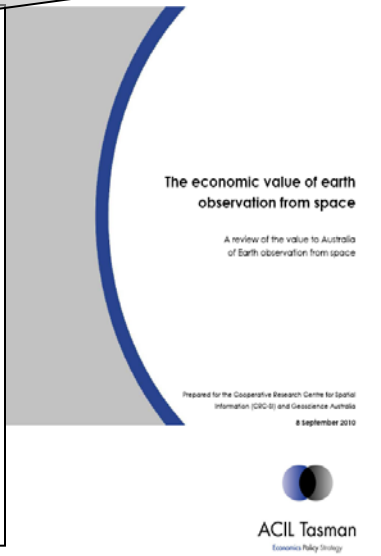
- Forest/Non-Forest for Carbon Accounting
- E.g. Time-Series Land-Cover Dynamics across the Continent
- Fire-affected areas
- Ecosystem & forest types
- Phenology
- Standing Biomass
- Fire Fuel loads
- Leaf Pigments and chemistry

NATONAL Space Policy Context and the EO R&D Sector

2008 2009 2010

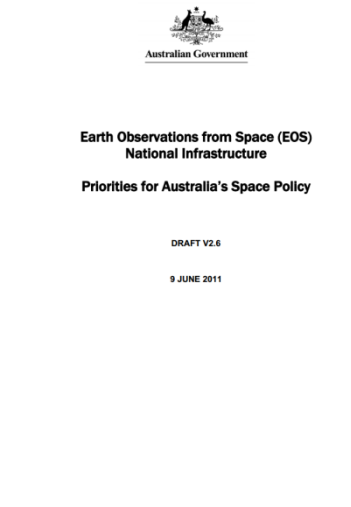


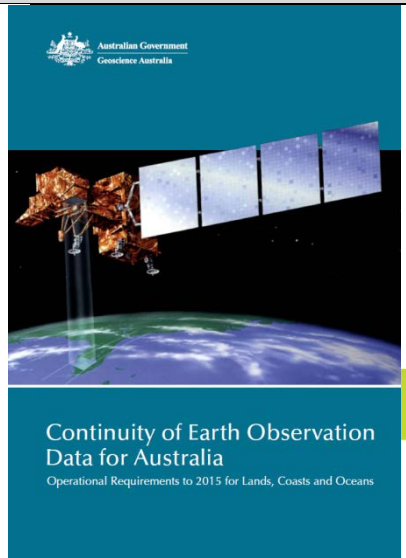


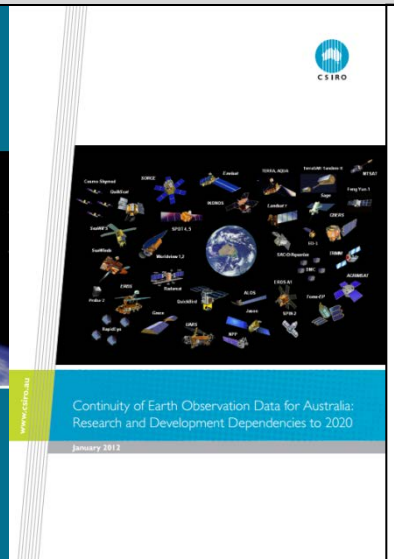


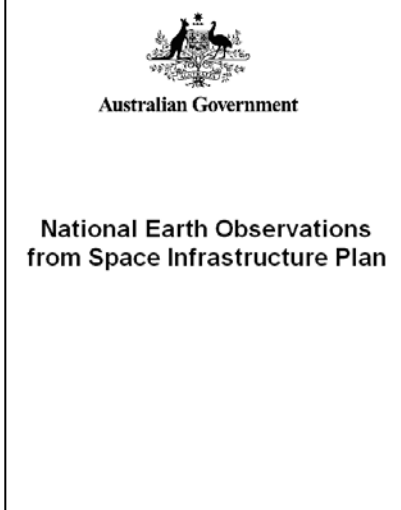
Process of gathering evidence for new Space Policy formulation and associated coordination

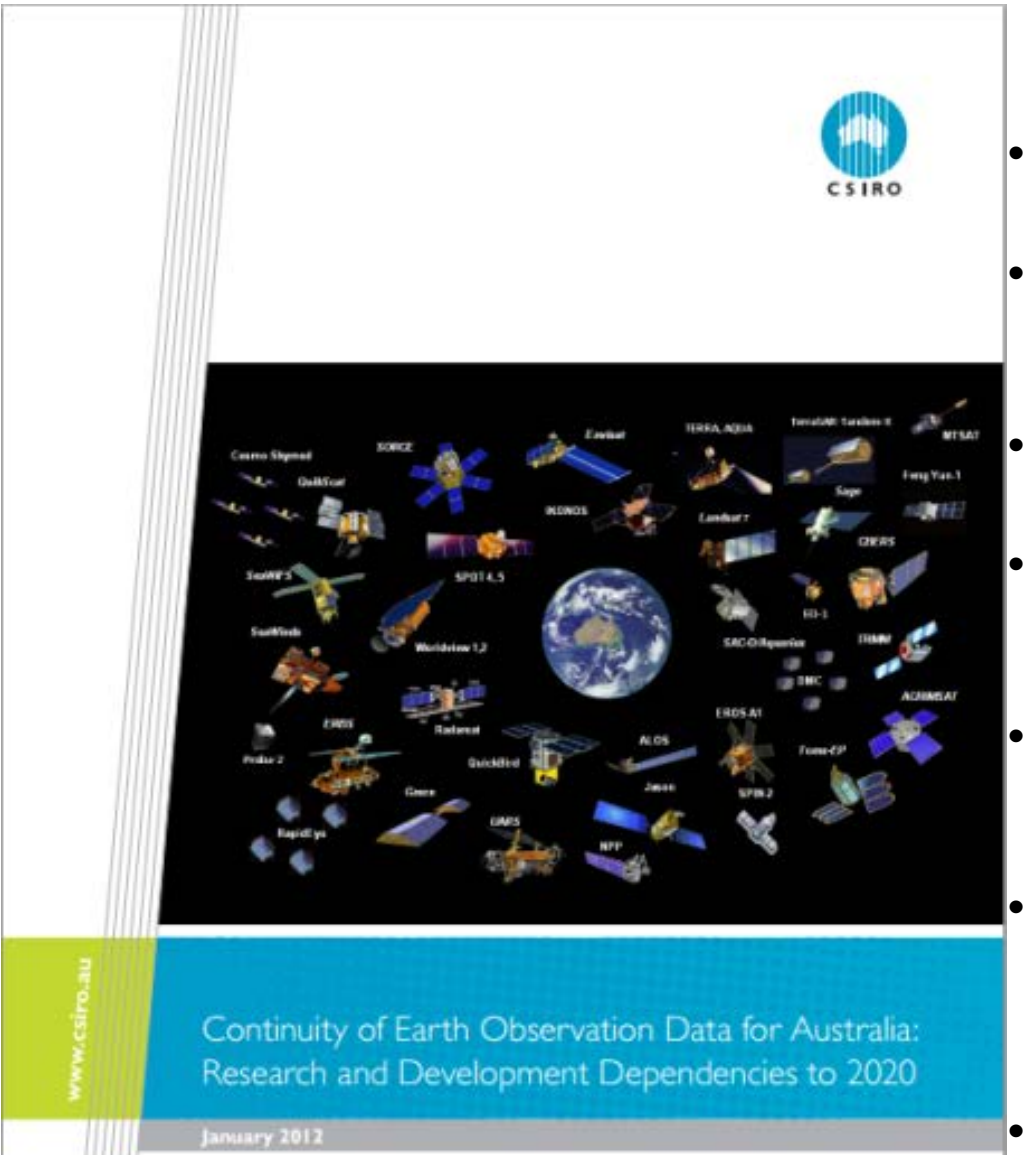
2011 2012











Report available via: www.space.gov.au

Study Objectives

- Determine importance EOS data in support of R&D project needs
- Identify role and magnitude of R&D effort, in support of operational government or commercial programs
- Identify EOS missions and priority data types of special importance to the R&D sector.
- Identify current relationships, space agency data providers and other research partners, are a priority
- Highlight opportunities for potential expansion of national/international collaborations and partnerships
- Identify ways in which the Australian EO R&D sector can contribute and support foreign programs (eg. Cal/Val, science team members, processing, etc.).
- Provide likely EOS access scenarios and continuity risks which face the R&D sector, and offer contingency scenarios

Acknowledgments: DIISRTE SPU; CEODA R&D Study Team (TORs, Design, Survey and Reporting)

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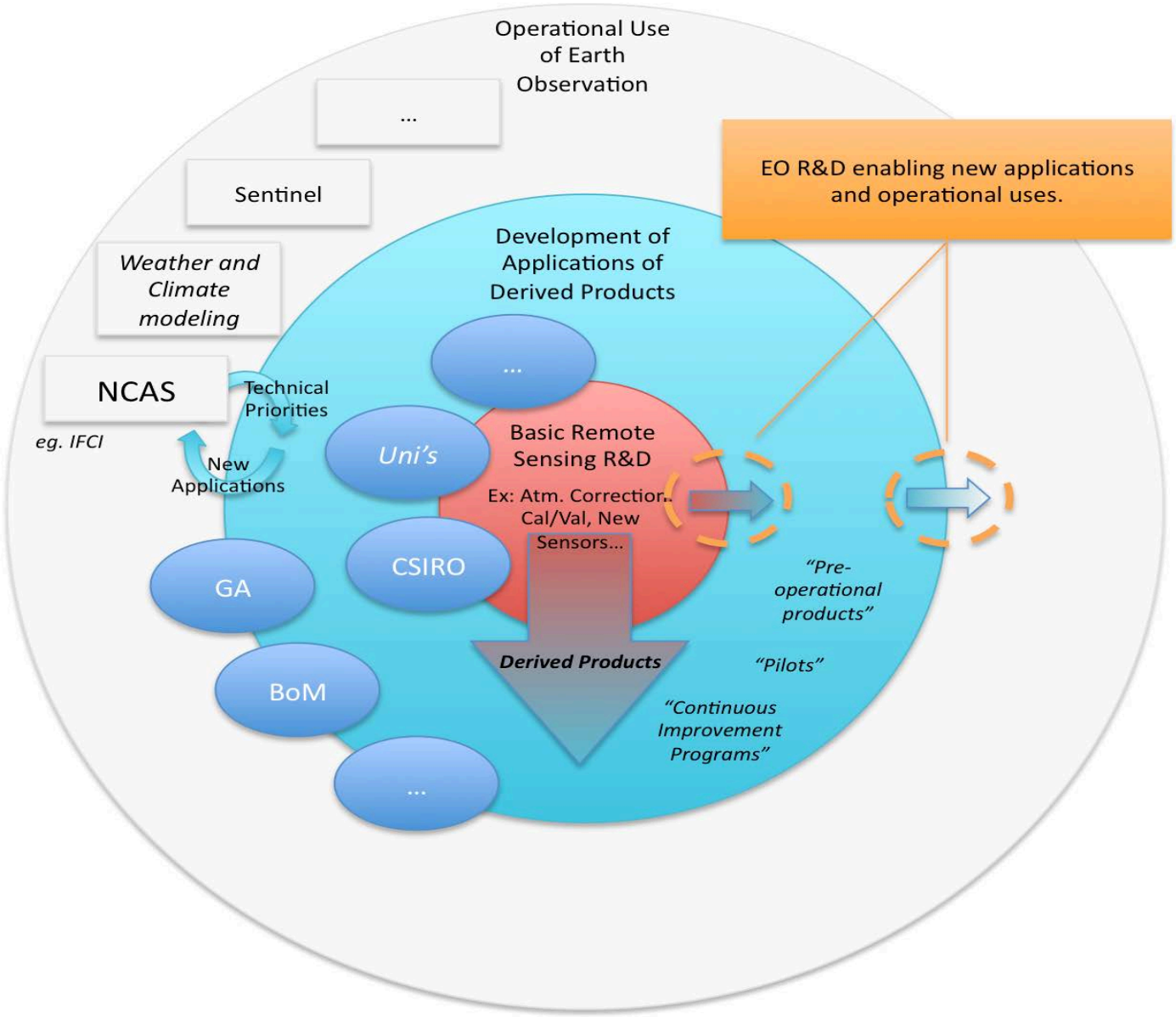
- Barbara Harrison (Harrison & Co.)
- Stephen Ward (Symbios Communications)
- George Dyke (Symbios Communications)

Australia's Diverse EO Research and Development Community

EO R&D Sector Definition in this Study: Primarily those doing actual R&D with EO data, …not just use EO as input to other work

- Identified 217 distinct current projects/teams
- Subset of 56 projects from 31 Organisations for further analysis:
  - Academic Institutions (universities);
  - Research Organisations (focussed on research and development, such as CSIRO, CRCs, CAWCR and WIRADA);
  - Federal Agencies (undertaking both operational and research projects);
  - State Agencies (undertaking both operational and research projects).
  - NGOs (?)
  - Private Sector (?)

Spectrum of the EO R&D Application Space



Institutional Representation

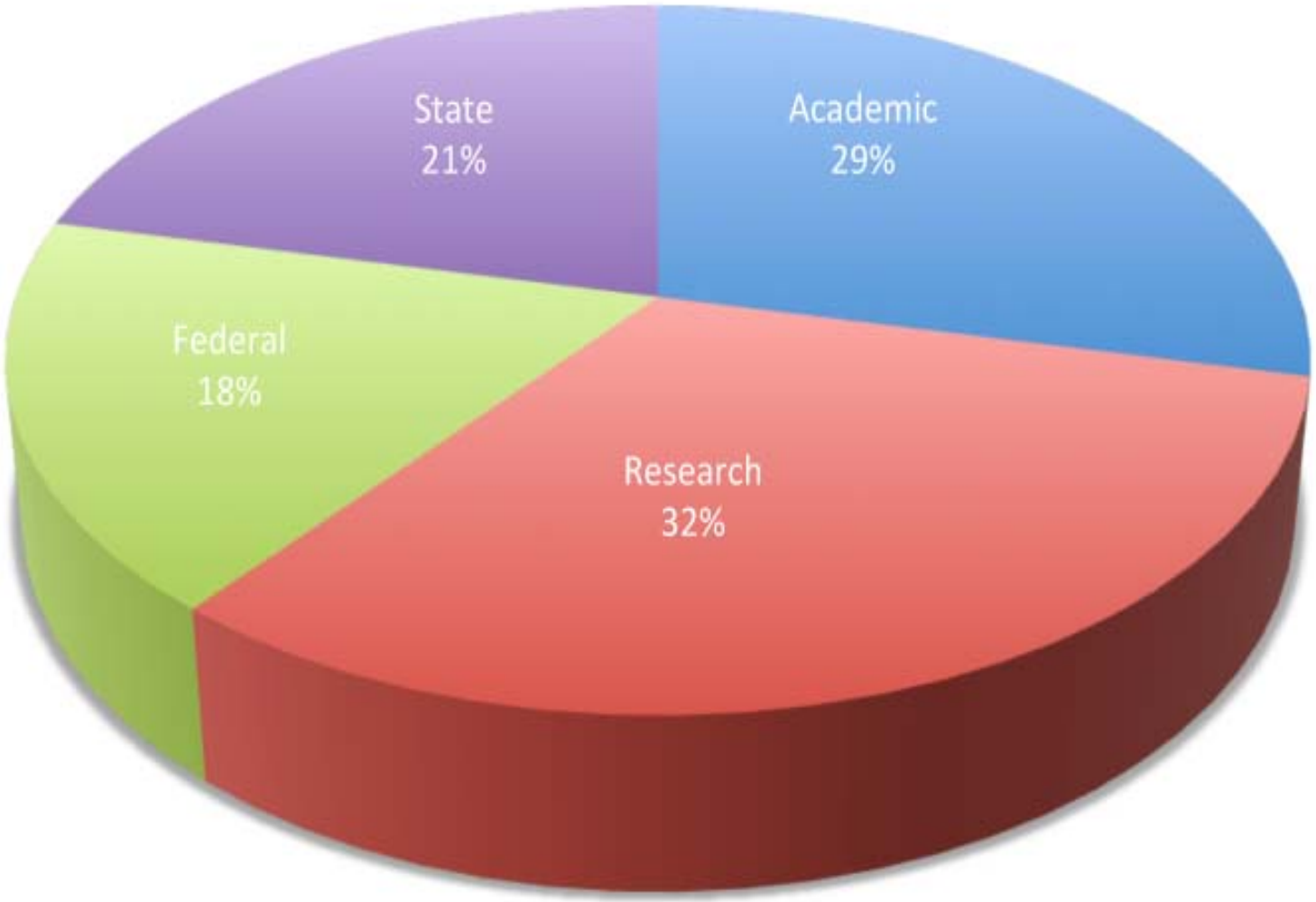


Table 2-1 Survey Approach

Survey Stage	Survey Worksheet	Topic	Information
Part 1	1	Organisation Information	High level details of the organisation responding to the survey
	2a	Research Projects	Listing of projects relevant to the survey within the research program and staff contact details
Part 2	2b	Project Outcomes, Benefits and Resources	Listing of project outcomes, societal benefits, operational linkages, staff and funding resources, and EO data importance
	3	Project Overview	Objectives, reference material and collaboration relevant to the project
	4	EO Data Requirements	Current EO data requirements, supply, and future requirements by instrument type
	5	EO Data Supply	Current EO data supply overview, agreements, calibration and validation, volumes and costs for each instrument
	6	Continuity and Future Trends	Project continuity, emerging technology, sensor types, and potential new applications

Information Gathered on EO Data Types

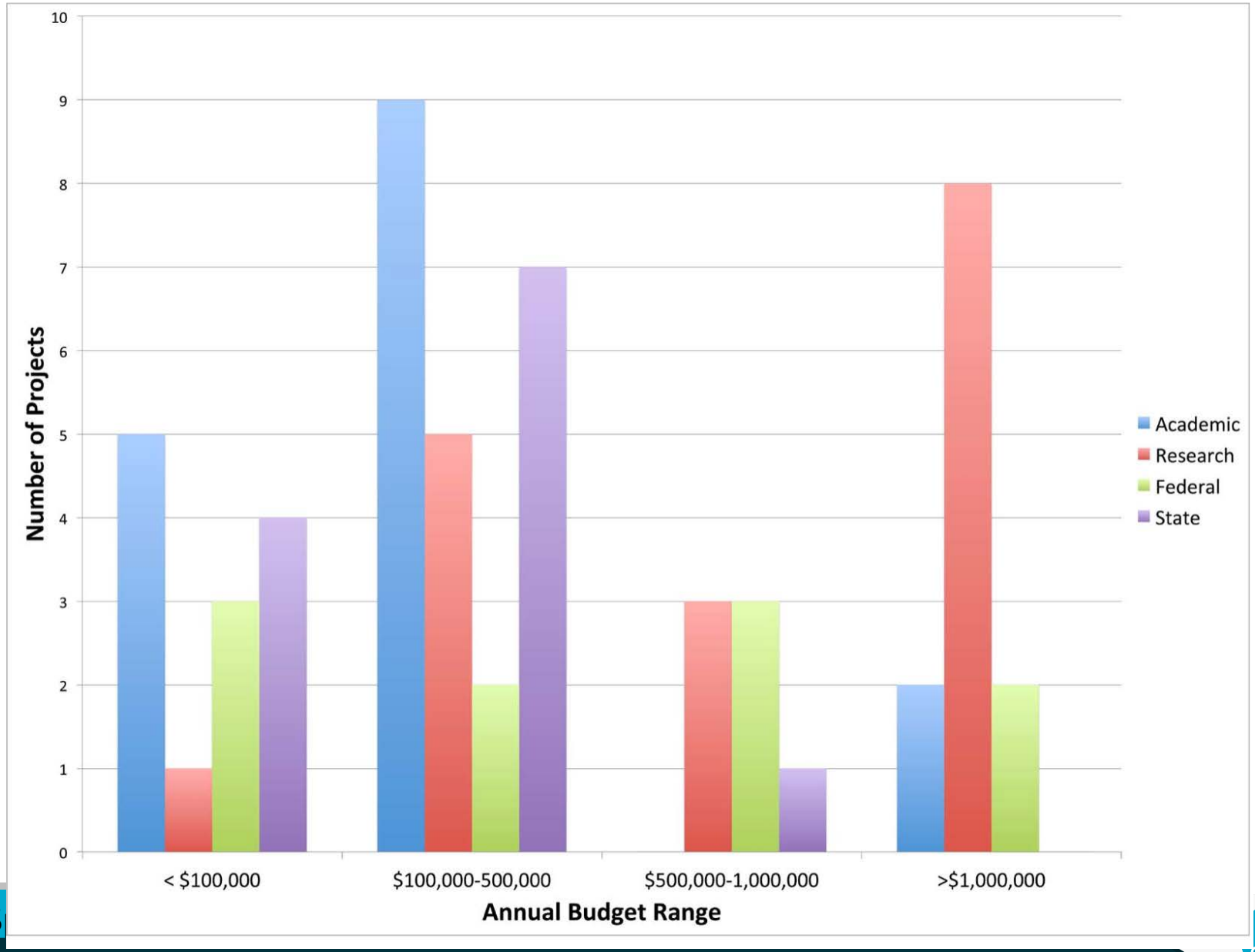
- Supply source and any substitutes available;
- Spatial resolution;
- Maximum extent of coverage;
- Coverage area;
- Number of coverages required per year;
- Specific regions of interest;
- Temporal coverage;
- Latency;
- Continuity and co-ordination requirements;
- Technical details;
- Expected data requirements in the 2-year, 5-year and 10-year timeframes; and
- Assessment of whether those requirements are expected to be met.

EO Data Needs - Supply Information

- Instrument name;
- Instrument agency;
- Instrument mission;
- Supply start and end dates;
- Supply agreement type;
- Unique agreement terms and conditions;
- Agreement duration;
- Physical supply route;
- Current infrastructure obstacles;
- Anticipated future data supply;
- Quality control procedures
- Data volume (annual and historical); and
- Data costs (annual and historical).

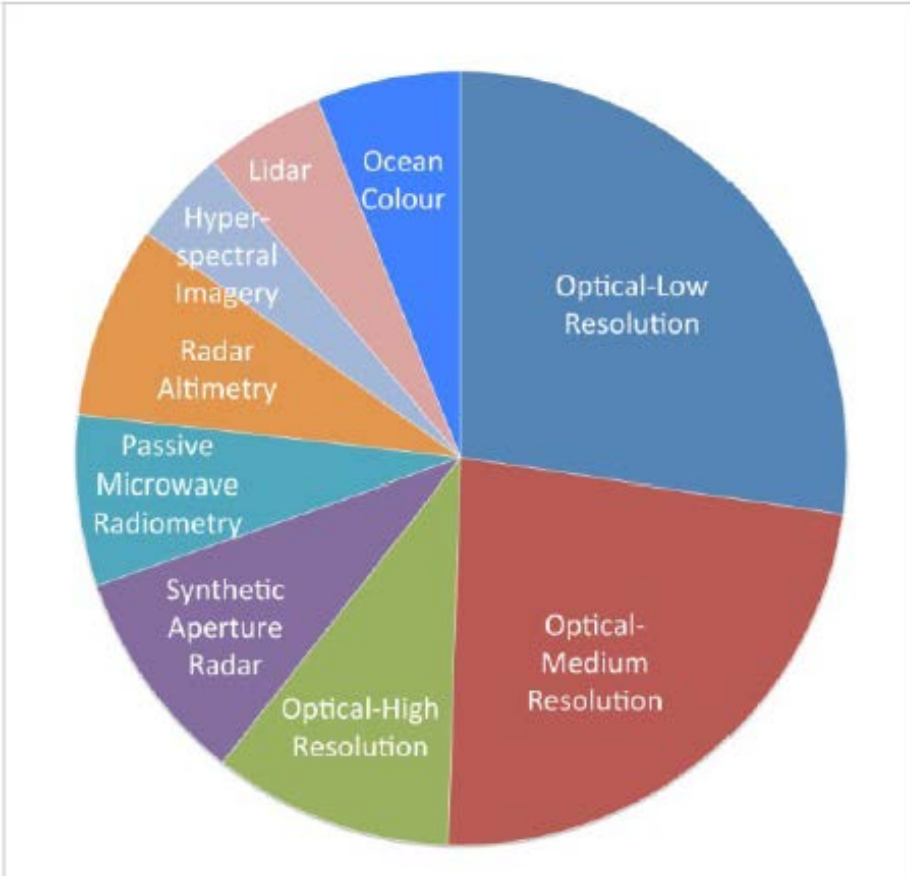
Key Results

Budgets – total about $35-45m+ p.a.



Priority Data Types based on No. of Projects in Survey

a. Satellite Data



b. Airborne Data

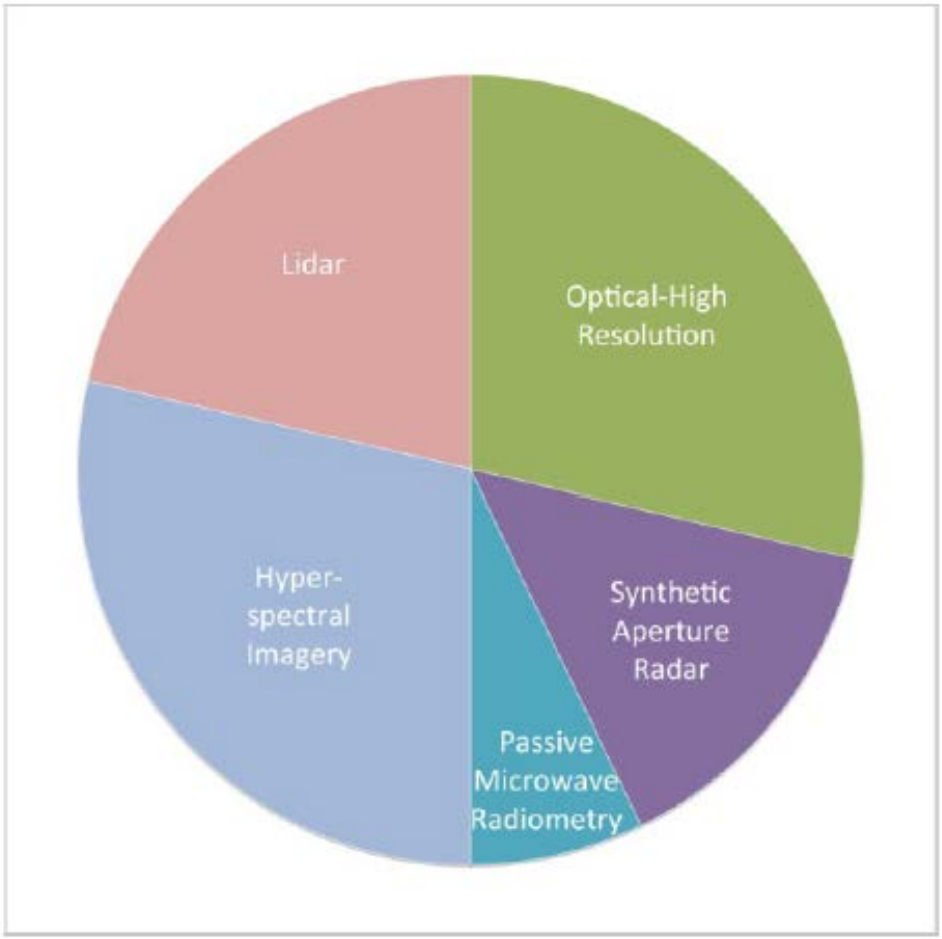


Table 5-9 Priority Data Types: Satellite Supply Continuity Risk & Key providers*

Priority EO Data Type	5-year continuity risk	Current key providers (and missions)	Future key providers (and missions)	Predominant Latency Requirement
Optical: Low Resolution	Low	NASA (MODIS) NOAA/EUMETSAT (AVHRR) JMA (MTSAT series)	ESA/EC (Sentinel-3 series) NOAA (NPP/JPSS series) JAXA (GCOM-C series) JMA (MTSAT series)	Hours/Weeks
Optical: Medium Resolution	High	USGS (Landsat-5/7)	USGS (LDCM) ESA/EC (Sentinel-2 series)	Days/Weeks
Optical: High Resolution	Low	USA commercial providers (Worldview, GeoEye)	USA & European commercial providers (Worldview, GeoEye, Pleiades) Airborne operators	Days/Weeks
SAR: C-band	Low	ESA (Envisat) CSA (Radarsat)	ESA/EC (Sentinel-1 series) CSA (Radarsat & RCM)	Weeks
SAR: L-band	No current supply	-	CONAE-ASI (SAOCOM-1A) JAXA (ALOS-2)	Weeks
SAR: X-band	Low	ASI (COSMO-Skymed) DLR (TerraSAR-X)	ASI (COSMO-Skymed series) DLR (TerraSAR-X series)	Weeks
Passive Microwave Radiometry	Medium	NASA (Aqua – just concluded) NOAA/DOD (DMSP series) JAXA/NASA (TRMM) ESA (SMOS)	JAXA/NASA (GCOM-W series) NASA (GPM, Aquarius, SMAP) NOAA/DOD (DMSP series) ESA (SMOS) ISRO (Megha-Tropiques, RISAT-3)	Hours
Radar Altimetry	Medium	EUMETSAT-NOAA (Jason series) ESA (Envisat)	EUMETSAT-NOAA (Jason series) ESA/EC (Sentinel-3 series)	Hours
Hyperspectral Imagery	High	NASA (EO-1)	DLR (EnMAP) ASI (PRISMA) METI/JAXA (ALOS-3)	Weeks
Lidar	High	NASA (CALIPSO)	ESA/JAXA (EarthCARE)	Weeks
Ocean Colour	Low	ESA (MERIS) NASA (MODIS) ISRO (OCEANSAT)	ESA/EC (Sentinel-3 series) JAXA (GCOM-C series) ISRO (OCEANSAT) NOAA (NPP/JPSS series)	Hours

*Based on number of projects using the data type not data volume or size/impact of project

Summary Key Findings (1)

- Australia is 100% reliant on foreign satellites
- R&D community using at least 59 different satellite data sources, across a wide field of applications and societal benefit areas, but not generally aware of continuity/contingencies..
- R&D community has tended to use ‘whatever free data is available’, provided it offers suitable data quality, continuity, coverage and access arrangements.
- Nine Priority Data Types have been identified, (in decreasing order of usage):
  - Low Resolution Optical;
  - Medium Resolution Optical;
  - High Resolution Optical;
  - SAR (C-, L- and X-band);
  - Passive Microwave Radiometry;
  - Radar Altimetry;
  - Hyperspectral Imagery;
  - Lidar; and
  - Ocean Colour.
- US satellite data remain by far most important supply of data to Australian researchers – key is continuity of high quality systems, free and open data policies, and direct broadcast capabilities into Australian receiving stations.

Summary Key Findings (2)

- Future supply may include increasing importance of the European Space Agency (ESA) and the Japanese Aerospace Exploration Agency (JAXA) with Germany, Canada, China-Brazil, India, Korea. – *Data policies, data quality and access to data are key to adoption by R&D sector.*
- The outlook for continuity is still dependent on many ad-hoc relationships, among individual Australian researchers and/or agencies, with data supply agencies – needs better coordinated and formal arrangements, plus inclusion in national EO infrastructure plans.
- Australia is in a strong economic position in 2011 relative to many of the countries funding these satellites, and it may be a 'high-risk' strategy to assume continued free access to these investments of other countries.
- The main supply agencies world-wide are moving to centralised, internet-based data distribution models with less reliance on foreign ground stations. It needs to be determined what impact this will have on data access on terms that meet Australian requirements for latency etc.
- There is a need for more coordinated, operational access and processing facilities, along the lines of the Terrestrial Ecosystem Research Network (TERN) and the Integrated Marine Observing System (IMOS) prototypes.
- The challenge is compounded by increased spatial, temporal, and spectral resolutions in future data requirements of researchers contributing to significant increases in data volumes.
- A direct contribution to international missions would also help to ensure future data access. The study identified future opportunities in relation to SAR, hyperspectral imagery, and Short Wave and Thermal Infrared data, as well as cost effective participation in one of the virtual international constellations.

Thank you

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